

Learning through doing: an online game for appropriating ontological modelling methodology

A. Guillem, G. Bruseker, N. Lercari



CAA2018 Tübingen



FORTH-ICS

S37 Connectivity: linking and interpreting the archaeological record

Challenge

- **High** potential of ontologies (CIDOC CRM & CRMarchaeo) to help integrate archaeological data.
- **BUT:** Uptake of ontologies and the CIDOC CRM, however, remains **relatively low**.
- **Why?** The learning curve to understanding and applying ontologies by archaeologists is currently **steep**.

Primary difficulties faced by new CRM learners



Critical
« do or die »
period

- Subject matter falls between disciplines
- Subject matter presented too theoretically for many
- Lack of enough qualified teachers
- Lack of learning materials & learner oriented tutorials
- Lack of examples

Solution: Learn through Doing

A card game version of the CRM ontology to teach basic ontology concepts and the ontology itself



- make subject matter interesting to new learners
- make subject matter simpler to appropriate
- provides mean to immediately interact with/apply the concepts in the ontology (removed from learning technical applications)
- show the application of the ontology through real examples

Simplifying the representation of CRM for learning

E2 Temporal Entity

Subclass of: [E1 CRM Entity](#)
Superclass of: [E3 Condition State](#)
[E4 Period](#)

Scope note: This class comprises all phenomena, such as the instances of E4 Periods, E5 Events and states, which happen over a limited extent in time. This extent in time must be contiguous, i.e., without gaps. In case the defining kinds of phenomena for an instance of E2 Temporal Entity cease to happen, and occur later again at another time, we regard that the former E2 Temporal Entity has ended and a new instance has come into existence. In more intuitive terms, the same event cannot happen twice.

In some contexts, these are also called perdurants. This class is disjoint from E77 Persistent Item. This is an abstract class and has no direct instances. E2 Temporal Entity is specialized into E4 Period, which applies to a particular geographic area (defined with a greater or lesser degree of precision), and E3 Condition State, which applies to instances of E18 Physical Thing.

Examples:

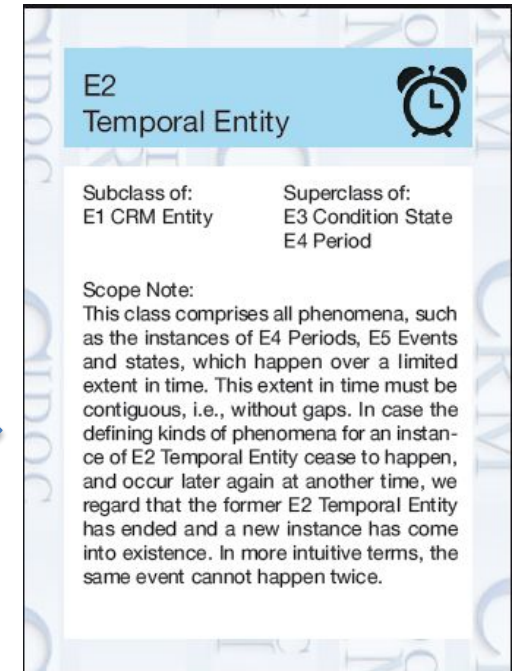
- Bronze Age (E4)
- the earthquake in Lisbon 1755 (E5)
- the Peterhof Palace near Saint Petersburg being in ruins from 1944 – 1946 (E3)

In First Order Logic:

$E2(x) \supset E1(x)$


Properties:

[P4](#) has time-span (is time-span of): [E52 Time-Span](#)
[P114](#) is equal in time to: [E2 Temporal Entity](#)
[P115](#) finishes (is finished by): [E2 Temporal Entity](#)
[P116](#) starts (is started by): [E2 Temporal Entity](#)
[P117](#) occurs during (includes): [E2 Temporal Entity](#)
[P118](#) overlaps in time with (is overlapped in time by): [E2 Temporal Entity](#)
[P119](#) meets in time with (is met in time by): [E2 Temporal Entity](#)
[P120](#) occurs before (occurs after): [E2 Temporal Entity](#)
[P173](#) starts before or at the end of (ends with or after the start of): [E2 Temporal Entity](#)
[P174](#) starts before (starts after the start of): [E2 Temporal Entity](#)
[P175](#) starts before or with the start of (starts with or after the start of): [E2 Temporal Entity](#)
[P176](#) starts before the start of (starts after the start of): [E2 Temporal Entity](#)
[P182](#) ends before or at the start of (starts with or after the end of): [E2 Temporal Entity](#)
[P183](#) ends before the start of (starts after the end of): [E2 Temporal Entity](#)
[P184](#) ends before or with the end of (ends with or after the end of): [E2 Temporal Entity](#)
[P185](#) ends before the end of (ends after the end of): [E2 Temporal Entity](#)



1 CRM class = 1 card

CRM Game Elements: 3 Decks

E22
Man-Made Object 

Subclass of: E19 Physical Object
E24 Physical Man-Made Thing

Superclass of: E84 Information Carrier

Scope Note:
This class comprises physical objects purposely created by human activity. No assumptions are made as to the extent of modification required to justify regarding an object as man-made. For example, an inscribed piece of rock or a preserved butterfly are both regarded as instances of E22 Man-Made Object.



Classes
Deck



P31
has modified
(was modified by)

Domain: E11 Modification
Range: E24 Physical Man-Made Thing



Relations
Deck

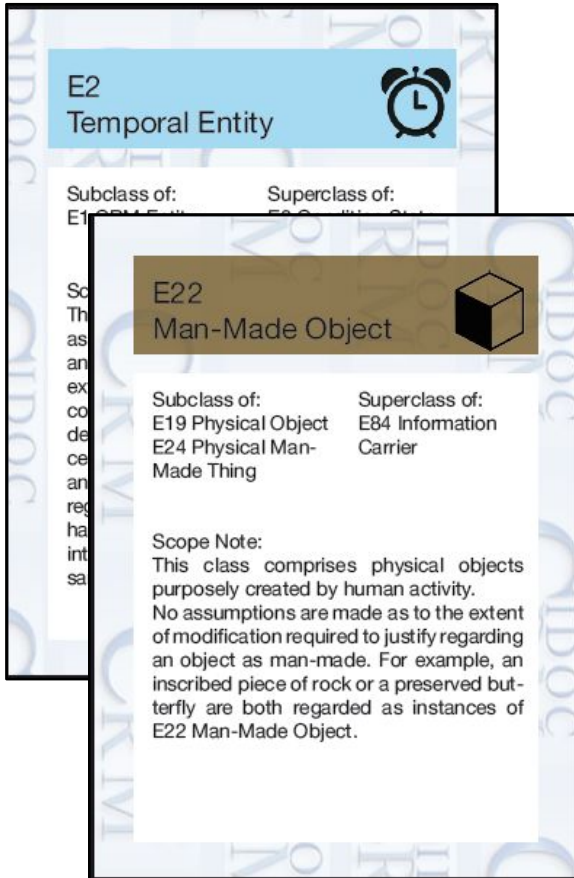
1-Priest type



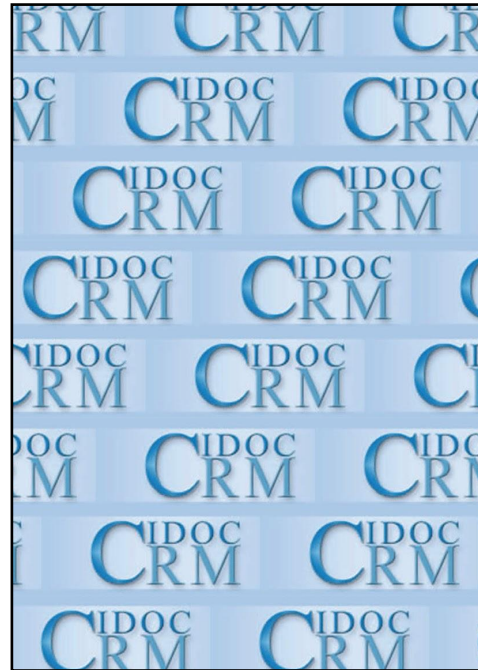
Instances
Deck

CIDOC CRM Class Cards Deck


Front



Back

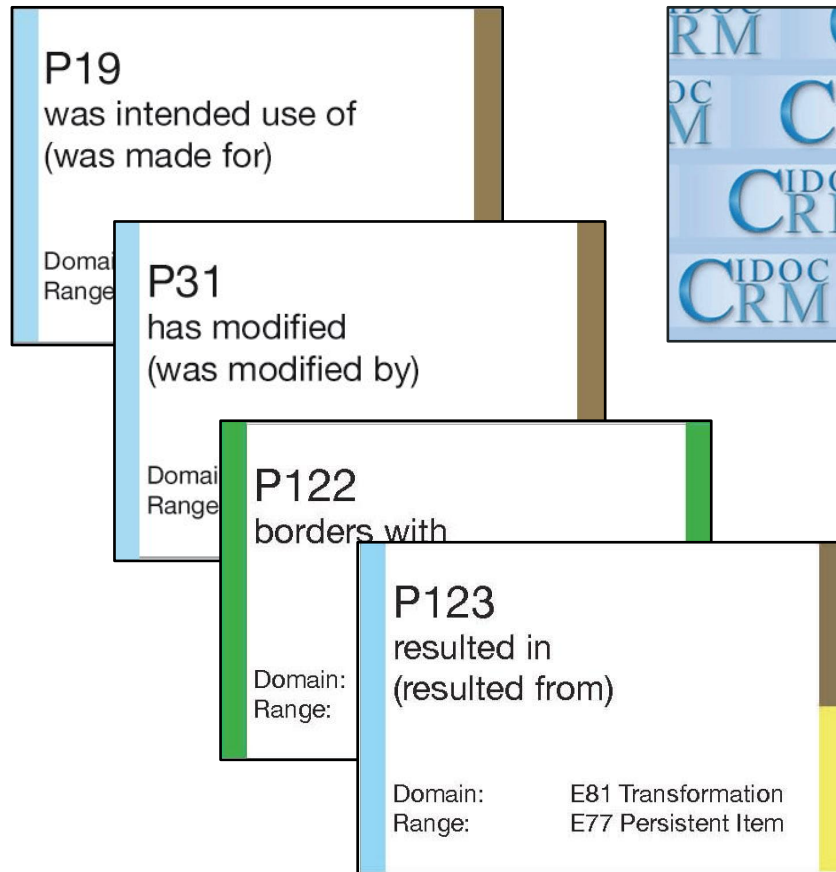


Color code

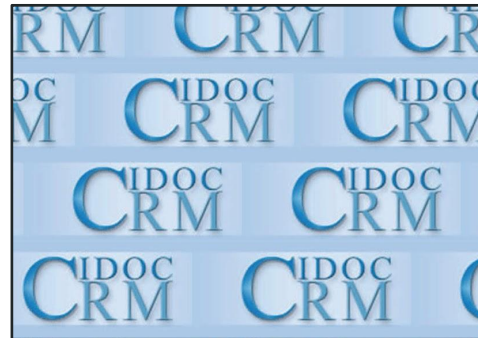
-  Temporal Entities
-  Actors
-  Physical things
-  Conceptual things
-  Appellation
-  Types
-  Places

CIDOC CRM Relation Cards Deck

Front



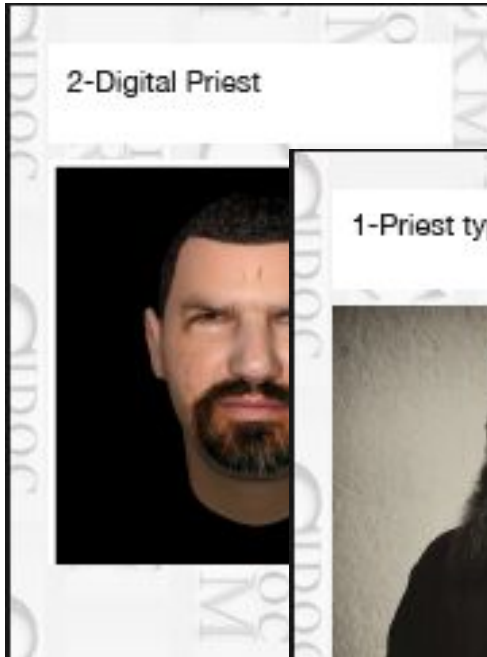
Back



Color code



Case-Study: Instance Cards Deck



Initial Tests & Feedback

- tested in classroom/workshop environments
- positive feedback from learners and teachers
- was helpful to learners to appropriate concepts
- was motivating to learners to attempt to apply CRM



Initial Conclusions Drawbacks



- Still requires a knowledgeable teacher
- Card format very intuitive but # of cards problematic
- Physical manipulation instructive but needs much space
- Time to produce a new game
- Effectiveness dependent on guidance in scenario

New Research Direction: CRM Online Game

- Translate CRM Game concept to an **online, single player game**
- Retain the **positive features of the physical game**
- Address drawbacks
- Open ended platform

CIDOC-CRM Game Online

The CIDOC-CRM game is an educational tool designed to help interested data modellers and mappers become familiar with the CIDOC CRM ontology in an intuitive way through doing hands on activities applying the classes, concepts and methods proposed by the CIDOC CRM on real cases.



New Research Direction: CRM Online Game

How?

- **Unity** platform for designing interactions, because popular, easy to use, sleek
- use of **simple, reusable spreadsheets** for generating all content and replicability



game_setup

ID	name	description	image	dataType	sourceText	Active
1	Julia Morgan Game	Based on the life and work of Julia Morgan this story provides instances to build basic knowledge in how to use CRM classes and instances.	BookConservationCards52-67-5	Architecture	JMNote	Yes
2	Book Conservation	Book and paper conservation studies deck shows how to apply CIDOC CRM in this context.	CRM_Game_CardsALL-Marmoulter-1	Paper Conservation		No
3	Asinou Church	This initial case study of Asinou Church provides instances to build basic knowledge in how to use CRM classes and instances for digital cultural heritage.	Pages de AsinouCardsALL-Asinou-1	Cultural Heritage		No
4	Excavations at Marmoulter	The archaeological case study of Marmoulter provides instances to build basic knowledge in how to use CRM classes and instances in archaeological context.		Archaeology		No
6						
7						

New Research Direction: CRM Online Game



- address needs of **asynchronous learners**
- Introduce **Teaching tools** in game
- Many **more examples**
- **Mini games** = targeted learning activities
- **Easier production of new versions** of the game for different user groups

The Case-Study provides a Story and a Dataset

- The **case-study** provides a story and a dataset for some specific targeted audience
- The **story** provides a modeling context for learning
- The **dataset** provides instances of entities and properties to model

Select a Case Study!



Julia Morgan Game

Architecture

Based on the life and work of Julia Morgan this story provides instances to build basic knowledge in how to use CRM classes and instances.

Book Conservation

Paper Conservation

Book and paper conservation studies deck shows how to apply CIDOC CRM in this context.

Asinou Church

Cultural Heritage

This initial case study of Asinou Church provides instances to build basic knowledge in how to use CRM classes and instances for digital cultural heritage.

Excavations at Marmoutier

Archaeology

The archaeological case study of Marmoutier provides instances to build basic knowledge in how to use CRM classes and instances in archaeological context.

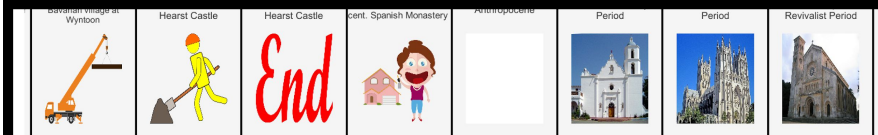
Julia Morgan Game

Description

Julia Morgan Bibliographical Note

Born(3) in San Francisco(2), Julia Morgan(1) (1872(4)-1957) grew up in Oakland(7) in a spacious Victorian house(8). Gifted in mathematics and encouraged in her studies by her mother(5), Morgan was influenced to become an architect by her mother's cousin, Pierre Le Brun (8), who designed(9) an early skyscraper(77), the

Card Previews



- **Game** = a structured playing environment, designed to build understanding of some aspect of the ontology

Game	Level	Objective
Limbo	1-6	This game introduces the basic concept of instance of classes and the major branches of the CIDOC CRM class hierarchy

- **Levels** = further division of game into targeted smaller learning steps

Game	Level	Objective
Limbo	1:	Event, thing, or place
Limbo	2:	Temporal Entities
Limbo	3:	Idea, Object or person



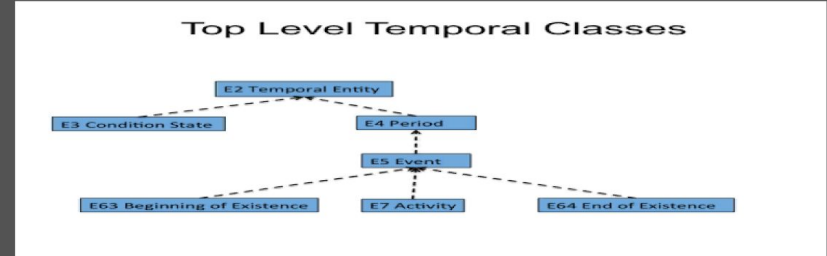
Limbo Game Level 2: Temporal Entities



What you need to know...

CRM Temporal Entities allow you to talk about things that happen through time with ever more precision. E2 Temporal Entity, allows you to talk about an event about which the only thing known is when it occurred either in absolute or relative time. Real world example of temporal entity are lacking, because this level of ignorance is typically not recorded in an information system. The class is useful for querving all other classes though.

Class Hierarchy Diagram



The Classes to Learn

E4 Period		E5 Event		E7 Activity		E63 Beginning of Existence		E64 End of Existence	
Superclasses	Subclasses	Superclasses	Subclasses	Superclasses	Subclasses	Superclasses	Subclasses	Superclasses	Subclasses
E2 Temporal Entity E92 Spacetime Volume	E5 Event	E4 Period	E63 Beginning of Existence E7 Activity E64 End of	E5 Event	E85 Joining E66 Formation E11 Modification	E5 Event	E67 Birth E66 Formation E12 Production E65 Creation	E5 Event	E6 Destruction E69 Death E68 Dissolution E81
"This class comprises sets of coherent phenomena or cultural manifestations occurring in time and space. It is the social or physical coherence of these phenomena that identify an E4 Period and		"This class comprises changes of states in cultural, social or physical systems, regardless of scale, brought about by a series or group of coherent physical, cultural, technological or legal		"This class comprises actions intentionally carried out by instances of E39 Actor that result in changes of state in the cultural, social, or physical systems documented. This notion includes		"This class comprises events that bring into existence any E77 Persistent Item. It may be used for temporal reasoning about things (intellectual products, physical items, groups of		"This class comprises events that end the existence of any E77 Persistent Item. It may be used for temporal reasoning about things (physical items, groups of people, living beings)	

Limbo Game: a game to introduce the notion of class instances and the major branches of the ontology to the player; here, learning about temporal entities.



Temporal Entities

TIME

86

RIGHT

LEVEL

WRONG

3

0

E4 Period

Superclasses	Subclasses
E2 Temporal Entity E92 Spacetime Volume	E5 Event

"This class comprises sets of coherent phenomena or cultural manifestations occurring in time and space. It is the social or physical coherence of these phenomena that identify an E4 Period and

E5 Event

Superclasses	Subclasses
E4 Period	E63 Beginning of Existence E7 Activity E64 End of

"This class comprises changes of states in cultural, social or physical systems, regardless of scale, brought about by a series or group of coherent physical, cultural, technological or legal

E7 Activity

Superclasses	Subclasses
E5 Event	E85 Joining E66 Formation E11 Modification

"This class comprises actions intentionally carried out by instances of E39 Actor that result in changes of state in the cultural, social, or physical systems documented. This notion includes

E63 Beginning of Existence

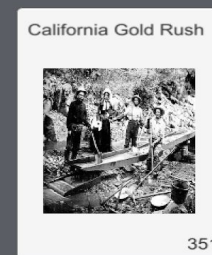
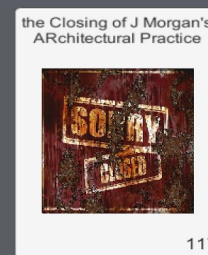
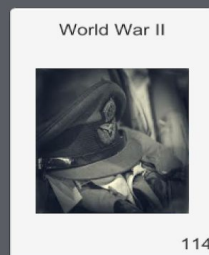
Superclasses	Subclasses
E5 Event	E67 Birth E66 Formation E12 Production E65 Creation

"This class comprises events that bring into existence any E77 Persistent Item. It may be used for temporal reasoning about things (intellectual products, physical items, groups of

E64 End of Existence

Superclasses	Subclasses
E5 Event	E68 Destruction E69 Death E68 Dissolution E81

"This class comprises events that end the existence of any E77 Persistent Item. It may be used for temporal reasoning about things (physical items, groups of people, living beings)

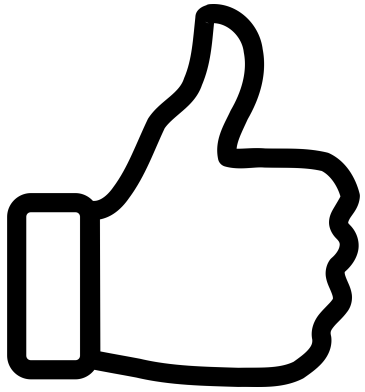


Examples of E4 in CRM manual:

- Jurassic
- European Bronze Age
- Italian Renaissance
- Thirty Years War
- Sturm und Drang
- Cubism

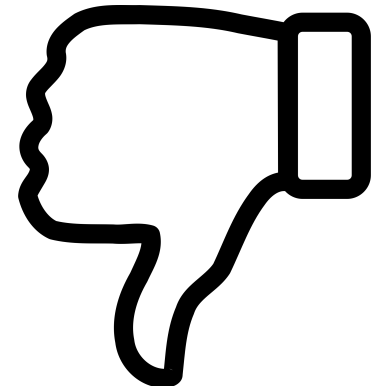
Demo...





Successes & Setbacks

- Makes the game independent from teacher
- # of cards unlimited
- No space limitation in virtual space
- CSV makes it fast to produce a new version of the game
- More structured learning scenarios, constant feedback for learner
- Problem to connect to triple store for live reasoning on instances
- No developer, hard to create fancier features/develop quickly



Future Work

Technical

- cleanup code
- replace csvs with a database to build story/game/level elements and a triple store to place instance elements

Content

- More story content through partnerships
- Address new audiences on their terms

Pedagogical

- add already planned games and conceive new games
- test effectiveness of the learning technique in controlled environments/circumstances



Thanks

- Anaïs Guillem (aguillem@ucmerced.edu)
- George Bruseker (bruseker@ics.forth.gr)